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Earliest dates and implications of Microlithic industries of Late Pleistocene from Mahadebbera and Kana, Purulia district, West Bengal

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Microlithic industries, a technology associated with modern humans, as defined by the production of microblades have been found in different parts of the Indian subcontinent with the earliest date being 48 ka. The present communication reports on recent archaeological excavations of these industries from a colluvial context located in the pediment surface of Precambrian hills in Purulia, West Bengal. These are dated to 34–25 ka by optically stimulated luminescence dating and are the earliest dates for microlithic industries in eastern India. To our knowledge such dating does not exist for any prehistoric site in Bengal. The context of the sites – hill-slope colluvium – is also unique and a rarity in the subcontinent. These findings add additional inputs to the knowledge of these industries, providing supporting evidence to their antiquity.

Keywords: Colluvium, excavation, microlihic industries, modern humans.

MICROLITHIC industries are defined by systematic microblade and/or backed artefact production associated with modern humans, found in different parts of the world at different timescales. Microblades are defined as blades (a blade is a flake with more or less parallel sides and length equal to twice its breadth) with a maximum dimension of 4 cm (ref. 1). Backed artefacts or microliths made on microblades are composite tools that were hafted on arrows or spears to hunt. Microlithic technologies have been invariably linked with modern human origins, dispersals and emergence of more complex human behaviour[2–4]. The antiquity of these cultures in the Indian subcontinent has been pushed back to 48,000 BP in Metakheri, Madhya Pradesh[5] and 35,000 BP in Jwalapuram, southern India[1], throwing new light on technological diversity, ecological situations and human behaviour in the Late Pleistocene. In this communication the discovery of microlithic industries of 42 ± 4 ka from Kana and 34 ± 3–25 ± 3 ka from Mahadebbera is discussed. Both are located on colluvium covered pediment surface in the foothills region of the Ayodhya hills in Purulia district,

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West Bengal (WB), composed of Precambrian rocks. The colluvium unit containing microblade artefacts at both the sites belongs to the Manbazar Formation of Kumari basin[6]. The dates derived by optically stimulated luminescence (OSL) dating technique provide the earliest chronology of these industries in Bengal and eastern India and give supportive evidence to the antiquity of microlithic industries in the Indian subcontinent. Microlithic industries of Tarafeni Valley, West Medinpur district, WB were relatively dated to Late/Terminal Pleistocene with significant information available on the palaeoenvironment[7]. Therefore, the present study substantiates these findings in Bengal. In eastern India only a single date of Late Pleistocene is available so far from Tripura for artefacts of late Middle Palaeolithic/Upper Palaeolithic period occurring in Late Pleistocene deposits (N. R. Ramesh, unpublished). In the Indian subcontinent, most Upper Paleolithic/ microlithic sites are reported from alluvial context, sand dunes or rock shelters[8]. There are very few late Pleistocene sites in a dated colluvial context in the Indian subcontinent. Patne located in the pediment surface of Ajanta hills, Jalgaon district, Maharashtra is one of the few exceptions[9].

The site (23°11′38.77″N: 86°11′53.3″E; 304 m amsl) of Mahadebbera is located within 500 m northwest of Ghatbera village, on the left bank of a low-order stream in the catchment area of Kumari river. It was discovered as part of intensive exploration in the region since 1998–1999 (ref. 10). The area of the site is 72 m × 50 m in the middle of a forest land, exposed by extensive erosional activity in the pediment zone. A 3/3 m trench was excavated revealing a stratigraphic column of 3.29 m thickness[11]. Another site at Kana (23°07′42.7″N: 86°12′47.5″E; 288 m amsl) is located about 500 m northwest of Kana village at the foothills of an inselberg. This site was discovered earlier[12] and was revisited by the first author in 2001 (ref. 13) and in 2012–13 when a section was cleared to understand the stratigraphy (Figure 1).

At Mahedebbera the artefacts were found *in situ*, consistently from a depth of 1.55–1.81 m (unit 2) in a reddish silty sand (confirmed by textural analysis) with cobbles of weathered schist, vein quartz and quartzite (almost 90% of the total deposit in this unit) and intermittently from the overlying deposit of moderately pedogenized reddish silty sand, between 0.15 and 1.55 m (unit 1; Figure 2 *a* and *b*). Moderate pedogenesis is indicated by crumbs and flaky peds. The entire deposit is part of a colluvial fill which has developed as an apron over the Precambrian bedrock ranging in elevation from 304 m (surface of the excavated trench) to 290 m (channel level of the low-order stream of Kumari). The hillslope colluvium is primarily a gravelly silty sand derived from Precambrian rocks of the denudational Ayodhya hills (700–300 m amsl). The various rock types include phyllite, mica schist, quartzite, amphibolites, epidorites, granite-gneiss, quartz-pegmatite vein and quartz breccias, indicating the presence of a shear zone[6]. The Kumari river cuts through this colluvium as seen in many exposed sections within a 10 km radius of the site. The proportion of silty clay in the excavated section is low as well in the exposed sections on the banks of the low-order streams and Kumari river. Soil creep, sheet flow with occasional and very strong, episodic flows of rainwater during summer southwest monsoon (as seen in the

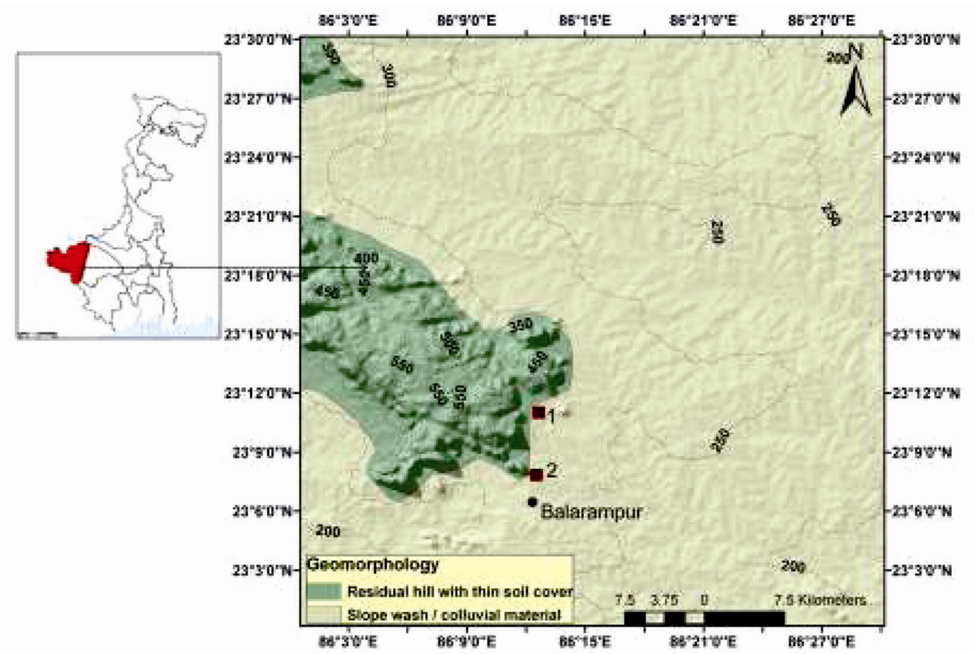

Figure 1. Geomorphological map showing Mahadebbera and Kana.

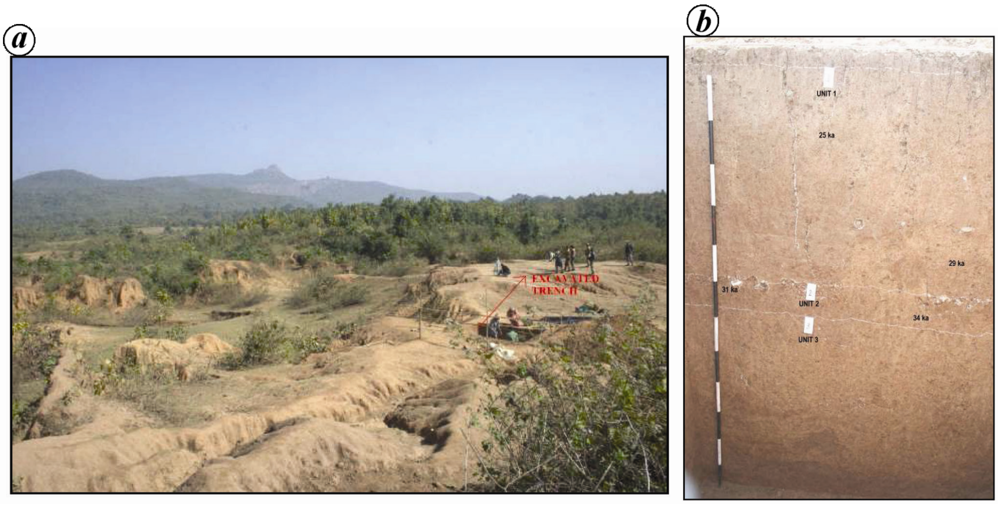

Figure 2. ***a***, Landscape of Mahadebbera showing the excavated trench. ***b***, Excavated section (3.29 m) at Mahadebbera.

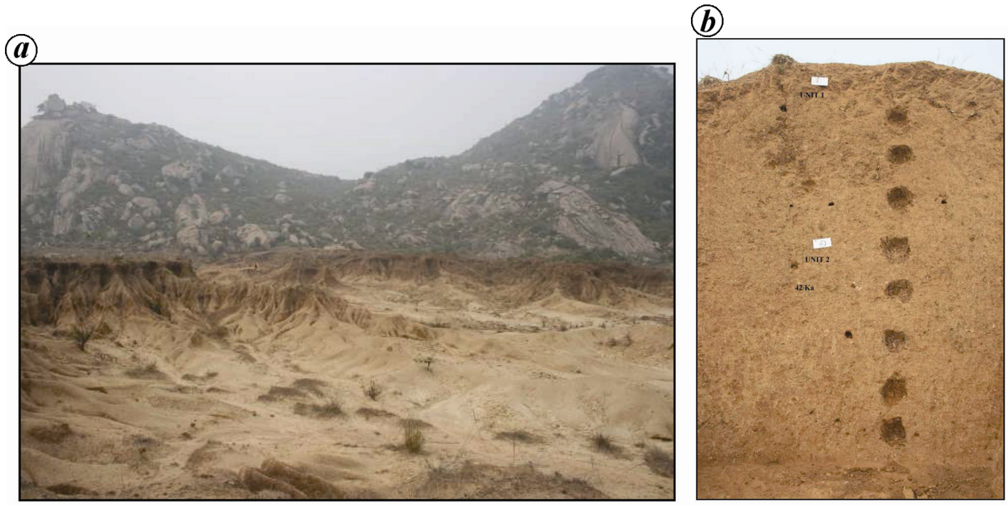

Figure 3. ***a***, Landscape at Kana showing pediment surface with artefacts exposed in colluviums. ***b***, Excavated section (2.47 m) at Kana.

constituents of unit 2 of the excavated trench) explain the mode of deposition of colluvium in this area during the Late Pleistocene. The rate of sedimentation was slow as seen from the section cleared at Mahadebbera (1.34 m within a period of 10 ka between 25 ± 3 and 34 ± 3 ka). That the deposition of colluvium is not continuous is indicated by weak/moderate pedogenesis, stabilized gravel layers with primary context microliths and excellent exposure of a more recent cut-and-fill sequence of 2 ka observed within 500 m downstream of the excavated trench.

At Kana, the pediment colluvium with an apron of ~5–6 m reddish-brown soil-sediment displays extensive badland topography (Figure 3 *a*). A section was cleared up to 2.47 m and artefacts were found *in situ* from a depth of 1.34–1.63 m and have been dated to 42 ± 4 ka (Figure 3 *b*). They are found in a context of gravelly silty sand which rests on a mottled greenish-grey clayey silt exposed at the bottom of the section that happens to be at the base level of the exposed badland. Blocks of various rock fragments, cobbles–pebbles of granite, gneiss, schist, ferruginous or iron–manganese soft pellets, muscovite and coarse to fine quartz sand derived from granite are strewn over the badland terrain, including artefacts that have eroded out of the *in situ* context and are distributed widely in the gullies extending approximately over an area of 150 m × 150 m.

Samples collected from Mahadebbera and Kana were dated using OSL dating technique to derive chronology of the artefact-bearing zones. This technique relies upon the fact that geological luminescence of sediment bleaches to near zero on exposure to sunlight during erosion and transport. Subsequent to this upon burial, the sediment starts accumulating luminescence from ionizing radiation in sediment column coming from the radioactive elements like uranium (U), thorium (Th) and potassium (K). Thus, the amount of stored luminescence is related to the time elapsed since the last event of its burial[14]. To estimate the date of last burial event, we therefore need to know the total accumulated luminescence, i.e. paleodose (*Ed*) and the rate at which the

Table 1. Age and dosimetry data from OSL

Sample	Laboratory no.	U (ppm)	Th (ppm)	K (%)	Water (%)	Dose rate (Gy/ka)	Cosmic ray dose rate (μGy/a)	Palaeodose (Gy)		Age (ka)	
								Mean	Least	Mean	Least 10%
KANA-1.4 m	LD-1366	1	16.6	2.4	15 ± 5	3.6 ± 0.2	150 ± 30	161 ± 13	142 ± 8	48 ± 5	42 ± 4
Ghatbera	LD-1367	4.2	6.2	1.8	15 ± 5	2.8 ± 0.2	150 ± 30	5 ± 1	5 ± 0.1	2 ± 0.4	2 ± 0.1
Maha-2.03 m	LD-1385	0.7	8.9	2.1	15 ± 5	2.6 ± 0.2	150 ± 30	100 ± 14	88 ± 4	39 ± 6	34 ± 3
Maha-1.8 m	LD-1386	1.8	11.2	2.2	15 ± 5	3.0 ± 0.2	150 ± 30	95 ± 12	86 ± 2	32 ± 5	29 ± 2
Maha-0.69 m	LD-1387	1.7	10.8	1.8	15 ± 5	2.6 ± 0.2	150 ± 30	75 ± 10	67 ± 5	28 ± 4	25 ± 3

Figure 4. Microblades–Mahadebbera.

Figure 5. Backed artefacts – first row, triangle; second row, points; third row, lunates; fourth row, backed blades.

paleodose is incorporated in the sediments, i.e. dose rate. *Ed* of these samples was estimated using standard chemical pretreatment procedures and subsequently following the single aliquot regeneration protocol[15]. Colluvial sediments that host the artefacts, due to rapid burial of mixed debris, may have been poorly or inhomogeneously bleached, which eventually may lead to overestimation of ages; minimum age model was used to overcome this problem[16]. Standard chemical pretreatment was given to samples[16] to remove organic matter and carbonate, and sieving followed by heavy liquid separation was carried out to get clean quartz (120–90 μm). Separated quartz was etched for 80 min to remove alpha-effected skin. The U, Th, K measurements to estimate dose rate were done using X-ray fluorescence. Table 1 provides details on age and dosimetry data. On the basis of OSL dates, the artefact context at Mahadebbera is dated between 34 ± 3 and 25 ± 3 ka and at Kana it is dated at 42 ± 4 ka.

A total of 111 artefacts were obtained from the excavated trench at Mahadebbera and 790 artefacts from the exposed context of the non-excavated area of the site by laying out grids and by dog-leash sampling method using Brunton compass and tape. The quantity obtained from the excavated trench is not as profuse as seen in the rest of the site. This may be explained by the erosional nature of the landscape, for which bulk of the artefacts has got eroded out of the context. The assemblage chiefly represents reduction of microblades and backed artefacts from microblade cores (Figure 4). The backed artefacts constitute lunates, points, triangles and backed blades with very few scrapers (Figure 5). The primary manufacturing stage was absent at the site, as no raw material nodules of the stones used, chert and felsic tuff, were found on site or in the near vicinity. Most of the cores are in the maximum size dimension of 2–3 cm (43) and those with a maximum size dimension of 3–4 cm number 24. This coincides with the maximum dimension of microblades and backed artefacts. Thus, it is clear that the cores were reduced primarily for the production of microblades and backed artefacts. Even the few cores larger than 4 cm that are present at the site were reduced to this size. The ratio of 7 cores to 151 flakes (in the excavated trench) and 69 cores to 544 flakes (in the non-excavated area) shows that considerable on-site reduction was present and/or substantial cores were taken away from the site.

The assemblage at Kana shows noteworthy differences from Mahadebbera in the presence of a small percentage of primary reduction seen in raw material nodules, large flakes of maximum size dimension of 4–6 cm and above, among which many have a cortex cover of >50%. Large flakes >6 cm may have represented another chain of reduction, separate from microblade production. Blade cores of maximum size dimension of up to 6 cm number only 7 at the site, while blades of that size are absent. Majority of the cores still fall in the 3–4 cm and 2–3 cm category (80%; 29; Figure 6). Possibly the debitage represents on-site reduction of blade cores, many of

Figure 6. Cores in different stages of exploitation – Kana.

which were transported from the site. The larger percentage of microblade cores still shows that microblade production was the dominant reduction method, attested to by the flaking debitage. However, the possibility of a small percentage of production of blades larger than this size cannot be discounted. The principal raw materials used in the manufacture of the artefacts are chert and felsic tuff, a small percentage of amphibolites and a black igneous rock. The first three were possibly brought from an area 10–15 km south of the sites[17] while that of the latter remains to be studied.

Human activity in the Late Pleistocene took place over colluvial pediment surface at both the sites. At Mahadebbera, the site is drained by ephemeral low-order streams in the catchment of the Kumari river. About 10 m below the site in the river section, bedrock is exposed in the stream bed unconformably overlain by the colluvial material, which in turn is overlain by a thin fluvial gravel bed. Coarse sandy matrix within the gravel framework yielded very young OSL date of 2k in comparison to the Late Pleistocene date of the underlying colluvium. This indicates that such ephemeral streams were non-existent during the recorded human activity near the site. On the other hand, at Kana no major drainage traverses the pediment surface; instead, there are a good number of shallow depressions surrounded by 2–3 m cliffs representing conspicuous badland terrain. These depressions are floored by granite overlain by residuals of weathered bedrock, colluvial debris and also gruss material that contains the artefacts. Some of the relict depressions are modern-day ponds.

To sum up, the importance of the study lies in the (i) dating of microblade industries of Late Pleistocene in eastern India; (ii) location of the sites in a hillslope colluvial context, which is rare in the Indian subcontinent and (iii) multi-disciplinary nature of the study.

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